

Urinary Retention Following General Anesthesia for Endoscopic Nasal Surgery in Men Aged Over 60 Years: A Retrospective Study

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Research article

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Abstract

Background: Postoperative urinary retention (POUR) after anesthesia and surgery is influenced by many factors, and its reported incidence rate varies widely. The aim of this study was to investigate the occurrence and risk factors for urinary retention following general anesthesia for endoscopic nasal surgery in male patients aged over 60 years.

Methods: Retrospective review of medical records between January 2015 and December 2019 identified 253 subjects for inclusion in our study. Age, body mass index, history of diabetes/hypertension, American Society of Anesthesiologists classification, and urologic history were included as patient-related factors. Urologic history was subdivided into three groups according to history of benign prostate hyperplasia (BPH)/lower urinary tract symptoms (LUTS) and current medication. The following were analyzed as perioperative variables for the development of POUR: duration of anesthesia and surgery; amount of fluid administered; rate of fluid administration; intraoperative requirement for fentanyl, ephedrine, and dexamethasone; postoperative pain; and analgesic use. Preoperatively measured prostate size and uroflowmetry parameters of patients on medication for symptoms were compared according to the incidence of urinary retention.

Results: Thirty-seven patients (15.7%) had urinary retention requiring catheterization. Among analyzed variables, only urologic history was identified as a predisposing factor. The incidence rate among patients without urologic issues was 5.9%. This compared to 19.8% among patients with a history of BPH/LUTS, which was not reduced by taking medical treatment. Among patients taking medication for symptoms, the maximal and average velocity of urine flow were significantly lower in subjects with POUR.

Conclusions: General anesthesia for endoscopic nasal surgery is a potent trigger of urinary retention in male patients aged over 60 years. The urological history of the patient was the most important risk factor, and the occurrence of POUR appears to be affected by urinary conditions. The present study is helpful in understanding the occurrence of POUR following general anesthesia in elderly male patients.

Background

Postoperative urinary retention (POUR) refers to a condition resulting in the inability to void, despite a distended bladder, in the early period after anesthesia and surgery. The criteria for defining POUR differ between studies and depend on the diagnostic methods used, such as history and physical examination, bladder catheterization, and ultrasound evaluation [1, 2].

Multiple factors have been studied as variables influencing the development of POUR, including: age, gender, history of lower urinary tract symptoms (LUTS), underlying diseases such as diabetes and hypertension, type and time of anesthesia and surgery, amount of fluid administered, use of narcotic analgesics, and urine volume in the bladder in the post-anesthesia care unit [1–4]. Due to the heterogeneous nature of the disease and multifactorial causes, a wide range of incidence rates have been reported (0.37-75%) [5, 6]. The causes of POUR can be largely divided into patient-, anesthesia- and

surgery-related factors. Among patient-related factors, age, and history of LUTS such as frequency, urgency, straining, and weak stream have been studied as important contributors to POUR. In a recent meta-analysis of 21 studies, older age, and history of LUTS increased the risk of POUR by 2.11 times and 2.83 times, respectively [1]. LUTS in men is mainly associated with benign prostate hyperplasia (BPH), and is known to increase in prevalence with age; it has been shown that 50–55% of men aged 50 years and over are affected by BPH/LUTS, compared to 80% aged 70 years and over [7].

With regards to anesthetic technique, general anesthesia is known to be associated with a lower incidence of POUR than spinal anesthesia, which causes POUR by blocking the sacral micturition reflex. Anesthetics cause contraction failure of the bladder by relaxing smooth muscle or restraining autoregulation of the detrusor muscle [8, 9].

With regards to the surgical procedure, it is known that POUR is commoner following anorectal surgery and orthopedic joint replacements compared to other forms of surgery and, in cases of abdominal surgery, is commoner in laparoscopic surgery compared to open surgery. Direct irritation of the urinary system during surgery can increase obstructive tension or swelling of the bladder outlet, and dysfunction of bladder contraction due to traction and displacement of the organ, long operation time, and a large amount of fluid requirement - and therefore the surgeon's proficiency - is also reported as an independent factor for the development of POUR [3, 10–12].

This study aimed to investigate factors affecting the incidence of urinary retention following general anesthesia for surgery in elderly male patients, who are considered to be a high risk group for developing POUR. The patients' urological history was subdivided according to the history of BPH/LUTS and current medical treatment. In addition, to minimize the direct effects of surgical stimulation to urination-related organs and related structures which may depend on a surgeon's proficiency, we focused on patients who underwent endoscopic nasal surgery.

To the best of our knowledge, no previously published research has investigated the effect of general anesthesia during endoscopic nasal surgery on POUR. This study was designed to improve our understanding of the effects of general anesthesia for surgery on urinary retention in elderly male patients with a urologic history.

Methods

This study was approved by the institutional review board of Veterans Health Service Daejeon Hospital (reference number: VHSDJ-01-2020-0011) and complies with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

We retrospectively reviewed the medical records of patients undergoing surgery in our otorhinolaryngology department between January 2015 and December 2019. Among them, men aged over 60 years who underwent endoscopic sinus surgery and septoplasty under general anesthesia were selected as subjects. We excluded patients undergoing surgery on sites other than the paranasal sinuses

and nasal cavities, and undergoing skin incisions in addition to the endoscopic approach. Among the identified patients, those requiring periodic catheterization and those with preoperative indwelling catheters were excluded.

The patient-related factors investigated include age, body mass index (BMI), diabetes and hypertension medication use, American Society of Anesthesiologists (ASA) classification, and urological medical history. Patients were divided into three groups according to their urology history: no history of BPH/LUTS (Group 1), a history of BPH/LUTS but not currently taking medication (Group 2), and receiving medical treatment for BPH/LUTS (Group 3). Patients who underwent prostate and bladder surgery via the transurethral approach (TUR-P and -B, respectively) were included in the study, and patients receiving radical surgery and radiotherapy for prostate cancer were excluded.

The patients in Group 2 were evaluated based on the last time they visited the urology department with BPH/LUTS. For patients in Group 3, we confirmed the medication prescribed at the time of operation for BPH/LUTS at the urology department. We investigated the examinations performed within one year prior to surgery, including the size of the prostate measured by transrectal ultrasound, and uroflowmetry parameters including maximal flow rate (Q_{max}), average flow rate (Q_{avg}), voided volume (VV, which should be over 150 ml), and post-voiding residual urine (PVRV). Variables related to anesthesia and surgery that were studied include the duration of anesthesia and surgery, total amount of fluid administered, rate of fluid administration, as well as the intraoperative requirement for fentanyl, ephedrine, and dexamethasone. Pain was assessed using the Visual Analog Scale (VAS) and intravenous analgesic use was checked postoperatively on the wards.

The duration of anesthesia was defined as the time from when the anesthesiologist first treated the surgical patient to the time the patient left the operating room, and the duration of surgery as the time from the endoscopic inspection of the nasal cavity to the time when intranasal packing was performed.

A person who complained of LUTS postoperatively was investigated. Among them, patients who underwent catheterization for urination despite suprapubic distension accompanied with pain or discomfort after surgery were defined as cases of POUR.

Continuous variables were expressed as mean \pm SD and p values were calculated using the Student's t-test. Normality tests were performed with the Shapiro-Wilk test, and if normality was not satisfied, the Mann Whitney U test was used. Categorical variables were denoted by frequency and percentages, and p values were calculated using the Chi-square test or Fisher's exact test. In univariate analyses, variables with a p value less than 0.1 were considered as independent variables in multiple logistic regression. Multiple logistic regression was used to identify significant risk factors for POUR. Associations between risk factors and POUR were summarized using odds ratios and 95% confidence intervals. All statistical analyses were conducted using the R Statistical Package, Version 4.0.1 (R Foundation for Statistical Computing, Vienna, Austria) and a p-value less than 0.05 was considered statistically significant.

Results

A total of 235 patients were included in the study (Table 1). The average age of the subjects was 69.9 ± 4.8 years (range 60–90), with 110 subjects aged in the 60 s (46.8%), 118 in the 70 s (50.2%), and 7 aged 80 and over (3.0%). The average BMI was 24.8 ± 3.2 kg/m² (range 11.9–34.8); there were 5 subjects classified as underweight (2.1%), 112 as having a normal weight (47.7%), 107 as overweight (45.5%), and 11 were defined as having class I obesity (4.7%). Seventy-four people (31.5%) received diabetes treatment, including insulin, and 160 (68.1%) took anti-hypertensive medication. There were 33 patients (14.0%) in ASA class I, 138 (58.7%) in class II, and 64 (27.3%) in class III.

Table 1
Demographic data and perioperative parameters of patients

Patients parameters	Subgroup	Mean \pm SD (range) or N (%)
Age (yrs)		69.9 \pm 4.8 (60–90)
	60–69	110 (46.8)
	70–79	118 (50.2)
	80-	7 (3.0)
Body mass index (kg/m ²)		24.8 \pm 3.2 (11.9–34.8)
	< 18.5	5 (2.1)
	18.5–24.9	112(47.7)
	25-29.9	107 (45.5)
	30-	11 (4.7)
Diabetes mellitus	No	161 (68.5)
	Yes	74 (31.5)
Hypertension	No	75 (31.9)
	Yes	160 (68.1)
ASA classification	class I	33 (14.0)
	class II	138 (58.7)
	class III	64 (27.3)
Urologic history	Group 1	68 (28.9)
	Group 2	46 (19.6)
	Group 3	121 (51.5)
Perioperative parameters		
Duration of anesthesia (min)		77.9 \pm 24.9 (30–160)
Duration of surgery (min)		53.7 \pm 24.4 (10–135)
Amount of fluid administered (ml)		784.0 \pm 298.8 (200–2000)
Rate of fluid administration (ml/hr/kg)		9.8 \pm 4.9 (2.2–33.6)
Intraoperative fentanyl use	No	222 (94.5)
Data expressed as mean \pm SD or frequency (percent of population). Abbreviations: ASA = American Society of Anesthesiologists, N = number of patients, POUR = postoperative urinary retention, VAS = visual analog scale.		

Patients parameters	Subgroup	Mean \pm SD (range) or N (%)
	Yes	13 (5.5)
Ephedrine requirement	No	116 (70.6)
	Yes	69 (29.4)
Intraoperative dexamethasone use	No	189 (80.4)
	Yes	46 (19.6%)
Postoperative pain score (VAS)		2.9 \pm 1.9 (0–8)
Postoperative analgesic use	No	146 (62.1)
	Yes	89 (37.9)
Data expressed as mean \pm SD or frequency (percent of population). Abbreviations: ASA = American Society of Anesthesiologists, N = number of patients, POUR = postoperative urinary retention, VAS = visual analog scale.		

When looking at subjects by group, 68 patients (28.9%) had no history of BPH/LUTS (Group 1), 46 patients (19.6%) had a history of BPH/LUTS but were not currently taking medication (Group 2), and 121 patients (51.5%) were currently receiving medication for BPH/LUTS (Group 3). Group 2 included 1 patient who had undergone TUR-P 10 years previously, and Group 3 included 1 patient who had undergone TUR-P 9 years previously, as well as 2 patients who had undergone TUR-B 1 and 3 years ago.

The average duration of anesthesia was 77.9 \pm 24.9 minutes (range 30–160), and the average duration of surgery was 53.7 \pm 24.4 minutes (range 10–135). The average total amount of fluid administered was 784.0 \pm 298.8 ml (range 200–2,000), and the average rate of fluid administration was 9.8 \pm 4.9 ml/hr/kg (range 2.2–33.6). For general anesthesia, propofol was used for induction and desflurane for maintenance of anesthesia. Rocuronium was used for muscle relaxation, and pyridostigmine with atropine and/or glycopyrrolate were used to reverse it. In 13 cases, intravenous fentanyl was used during maintenance. Ephedrine was used as a vasopressor in 69 patients during anesthesia. Dexamethasone was used in 46 cases on request of the anesthetic or surgical teams. There were no patients that required blood transfusion during surgery, and normal saline or balanced crystalloid were used as maintenance fluids.

In the ward, all patients were encouraged to urinate with sufficient time prior to surgery. Postoperatively, the pain score of the surgical site assessed using the VAS averaged 2.9 \pm 1.9 (range 0–8). Eighty-nine patients (37.9%) received paracetamol or ketorolac for pain control, and no narcotic analgesics were administered.

Among 235 patients, 50 patients (21.3%) complained of urinary difficulty including hesitation, frequency of urination, and a sense of incomplete bladder emptying. Thirty-five (15.7%) required catheterization due to suprapubic distension accompanied by pain and discomfort, and these patients comprised the POUR

group. Twenty-five of these 37 patients did not develop further urinary retention after one episode of catheterization, and 12 were treated more than twice; of these, 5 were treated with an indwelling catheter (1 in Group 2, and 4 in Group 3). All patients received catheterization prior to spontaneously urinating beforehand, except for two patients in Group 3 who had urinary retention after spontaneous voiding. The average amount expelled during catheterization was 682.1 ± 213.1 ml (range: 400-1,200).

The patients with POUR and the remaining 198 patients without POUR were compared statistically (Table 2). Age, body mass index, duration of anesthesia, duration of surgery, total amount of fluid administered, rate of fluid administration, and postoperative pain scores were compared between patients with POUR and without POUR; however, there were no statistically significant differences between variables, including age and BMI, which was associated with a p value of less than 0.1.

Table 2
 Perioperative variables in those that did and did not develop postoperative urinary retention

variables	With POUR (N = 37)	Without POUR (N = 198)	P-value
Age (yr)	71.4 ± 4.9	69.6 ± 4.8	0.073
Body mass index (kg/m ²)	23.9 ± 2.7	24.9 ± 3.2	0.071
Diabetes treatment			0.272
No	22 (59.5)	139 (70.2)	
Yes	15 (40.5)	59 (29.8)	
Hypertension medication			0.375
No	9 (24.3)	66 (33.3)	
Yes	28 (75.7)	132 (66.7)	
ASA classification			0.806
class I	4 (10.8)	29(14.6)	
class II	22(59.5)	116(58.6)	
class III	11(29.7)	53(26.8)	
Urologic History			0.030
Group 1	4 (10.8)	64 (32.3)	
Group 2	9 (24.3)	37 (18.7)	
Group 3	24 (64.9)	97 (49.0)	
Duration of anesthesia (min)	80.1 ± 25.9	77.5 ± 24.7	0.380
Duration of surgery (min)	53.2 ± 24.4	56.5 ± 24.5	0.300
Amount of fluid administered (ml)	836.5 ± 308.1	774.2 ± 296.8	0.149
Rate of fluid administration (ml/hr/kg)	10.5 ± 5.8	9.7 ± 4.7	0.371
Intraoperative fentanyl use			0.129
No	33 (89.2)	189 (95.5)	
Yes	4 (10.8)	9 (4.5)	
Ephedrine requirement			0.52
No	24 (64.9)	142 (71.7)	
Data expressed as mean ± SD or frequency (percent of population). Abbreviations: ASA = American Society of Anesthesiologists, N = number of patients, POUR = postoperative urinary retention, VAS = visual analog scale.			

variables	With POUR (N = 37)	Without POUR (N = 198)	P-value
Yes	13 (35.1)	56 (28.3)	
Intraoperative dexamethasone use			0.737
No	31 (83.8)	158 (79.8)	
Yes	6 (16.2)	40 (20.2)	
Postoperative pain score (VAS)	2.8 ± 2.0	2.9 ± 1.9	0.571
Postoperative analgesic use			0.576
No	25 (67.6)	121 (61.1)	
Yes	12 (32.4)	77 (38.9)	
Data expressed as mean ± SD or frequency (percent of population). Abbreviations: ASA = American Society of Anesthesiologists, N = number of patients, POUR = postoperative urinary retention, VAS = visual analog scale.			

Diabetes treatment (yes/no), hypertensive medication (yes/no), ASA classification (I/II/III), Urological history (group 1/2/3), intraoperative fentanyl use (yes/no), ephedrine requirement (yes/no), intraoperative dexamethasone use (yes/no), and postoperative analgesic use (yes/no) were analyzed as univariates, and only urologic history was associated with statistical significance ($p = 0.030$).

In multiple logistic regression, the odds ratio for age was 1.07 (95% confidence interval 0.98–1.16) and the odds ratio of BMI was 0.89 (95% confidence interval 0.79–1.00), both of which showed no statistical significance. Only urologic history was associated with statistical significance (Table 3); the incidence in Group 1 was 5.9% (4/68), in Group 2 was 19.6% (9/46), and in Group 3 was 19.8% (24/121; Fig. 1). Compared with Group 1, the odds ratio in Group 2 was 3.93 (95% confidence interval 1.18–15.18, $p = 0.035$), and the odds ratio in Group 3 was 4.61 (95% confidence interval 1.45–13.94, $p = 0.008$).

Table 3
Logistic regression analysis with urinary retention requiring catheterization as the dependent variable.

Variable	Univariate analysis			Multivariate analysis		
	P-value	OR	95% CI	P-value	OR	95% CI
Age	0.035	1.08	1.01–1.16	0.116	1.07	0.98–1.16
BMI	0.073	0.90	0.81–1.01	0.054	0.89	0.79-1.00
Urologic history						
Group 1	-	1.00	-	-	1.00	-
Group 2	0.032	3.89	1.18–15.18	0.035	3.93	1.16–15.73
Group 3	0.014	3.96	1.45–13.94	0.008	4.61	1.63–16.76

Abbreviations: BMI = body mass index (kg/m²), CI = confidence interval, OR = odds ratio, POUR = postoperative urinary retention.

Overall, the last time that patients in group 2 visited the urology department was 36.9 ± 34.0 months ago (range 2-120) on average; for patients with and without POUR, the interval was 45.3 ± 38.9 months and 34.8 ± 33.0 months, respectively. There was no statistically significant difference (p = 0.3825).

All patients in Group 3 were taking an α-blocker, and 31 of them were taking this together with a 5α-reductase inhibitor. It was possible to confirm the size of the prostate with rectal ultrasound in a total of 84 patients (18 patients with POUR, 66 patients without POUR), and there was no significant difference in the size of the prostate between the two groups (POUR: 32.3 ± 19.0 ml vs without POUR: 34.3 ± 13.7 ml, p = 0.1765).

The parameters of uroflowmetry and the time interval between the uroflowmetry assessment and the operation (TI) were compared in the patients with POUR (N = 10) and without POUR (N = 49) in group 3 (Table 4). In patients with POUR, the average Qmax was 12.7 ± 4.9 ml/sec, which was lower than the 19.9 ± 10.3 ml/sec average in patients without POUR (p = 0.002). Furthermore, the Qavg in patients with POUR was 6.6 ± 2.5 ml/sec lower than the 9.3 ± 3.2 ml/sec in patients without POUR (p = 0.016). There was no statistically significant difference between the two groups with regards to the VV, PVRU, and TI.

Table 4
Comparison between parameters of preoperative uroflowmetry of patients in group 3.

	With POUR (N = 10)	Without POUR (N = 49)	P-value
Qmax (ml/sec)	12.7 ± 4.9	19.9 ± 10.3	0.002
Qavg (ml/sec)	6.6 ± 2.5	9.3 ± 3.2	0.016
VV (ml)	255.1 ± 80.5	305.6 ± 141.9	0.479
PVRV (ml)	35.0 ± 28.1	32.5 ± 31.0	0.642
TI (days)	117.3 ± 102.9	182.4 ± 125.0	0.122

Abbreviations: N = number of patients, PVRV = postvoiding residual urine volume, Qavg = the average urine flow rate, Qmax = the maximal urine flow rate, TI = time interval between examination of uroflowmetry and operation, VV = voided urine volume.

Discussion

Endoscopic nasal surgery is classified as an intermediate operation, as are herniorrhaphy and total hip replacement, according to the expected levels of postoperative pain [13]. POUR after otorhinolaryngologic surgery has been rarely studied compared to other surgeries and is thought to be due to the relatively low incidence rate compared to abdominal and orthopedic surgery. It has also received limited research interest. However, we believe that there are some advantages of using otorhinolaryngologic surgery to help understand the incidence of POUR. Endoscopic nasal surgery is a conservative operation without an external skin incision and is not likely to have a direct effect on the urinary system. It also includes a relatively wide range of durations of anesthesia and surgery, as well as total amounts and rates of fluid administration. Therefore, our study could be very helpful in understanding the relationship between general anesthesia and the occurrence of POUR, and in examining POUR that occurs after intermediate surgeries, such as herniorrhaphy and total hip replacement, especially in elderly men.

Causes of urinary retention can be divided into obstruction of the bladder outlet, disruption of sensory and motor innervations, and myogenic failure due to bladder overdistention [3]. Obstruction of the bladder outlet may be associated with obstructive urinary symptoms including BPH, increased sympathetic nervous activity due to surgical stimulation and postoperative pain, and the effect of drugs which can stimulate alpha adrenergic receptors [14].

Reducing the resistance of the bladder outlet has been suggested as a strategy to lower the incidence of POUR, and prophylactic treatment with an alpha blocker, which is a mainstay of BPH treatment, has been studied. It has been reported to reduce the incidence of POUR in patients without urologic problems after hernia surgery, but it does not lower the incidence rate of POUR when it is used for 7 days in patients undergoing rectal cancer surgery [15, 16]. In addition, there was a recent report that the use of

dexamethasone during hernia surgery can lower the incidence of POUR, which could reduce swelling of the bladder outlet and prostate [17].

Ephedrine is one of the most widely used vasopressor drugs during anesthesia, with a half-life of about 3–6 hours as well as alpha and beta non-selective receptor stimulation [18]. Since it is well-recognized as a cause of acute urinary obstruction and was used by 69 (29.4%) elderly males in this study, it was believed to have a possible link to POUR; however, there was no statistical significance in univariate analysis. Interestingly, the intraoperative use of dexamethasone, the degree of postoperative pain, and the use of analgesics after surgery also did not affect the incidence of POUR. In this study, the factors thought to be related to the resistance of the bladder outlet were not associated with urinary retention. Old age, anesthetics, anticholinergic drugs, and narcotic analgesics are thought to relate to disturbances of sensory and motor innervations involved in micturition. It is known that the incidence of POUR increases in older patients due to decreased bladder function, due to degenerative changes in their nerves and muscles [1, 4]. In this study, in which the subjects were over 60 years old, the mean age of patients with POUR was slightly higher than patients without POUR, though there was no statistical significance between the two groups ($p = 0.073$).

Anticholinergic drugs such as atropine and glycopyrrolate in combination with pyridostigmine, used to restore muscle relaxation in general anesthesia, also act on the detrusor muscle of the bladder leading to a decrease in contractile capacity [19, 20]. Given that these agents were used along with general anesthetics in all patients, they could not be used as variables for analysis. Fentanyl, a narcotic analgesic, can cause a decrease in the ability of contraction of the bladder and reduce the sensation of urination [21]. It was given intravenously to 13 patients during anesthesia, and there was no difference in the incidence of POUR in relation to its use. Overfilling of the bladder during operation can cause excessive stretching of smooth muscles, muscle fatigue, ischemia, and axonal degeneration to result in myogenic failure of the bladder muscle [3, 4]. It was said that this situation was directly related to the length of surgery and anesthesia and the total amount of fluid administered. The volume of the bladder in the post-anesthetic care unit measured by ultrasound was reported to predict the occurrence of POUR [20].

In this study, the duration of anesthesia and surgery, and the total amount of fluid administered were investigated but not found to be related to POUR. Higher rates of fluid administration per weight were suspected to result in overloading of the bladder in a relatively short duration with an amount of fluid sufficient to avoid POUR, but there was no statistical difference between patients with and without POUR. The only variable associated with urinary retention following general anesthesia for endoscopic nasal surgery was the patient's urological history. The incidence of POUR in patients who did not experience BPH/LUTS was 5.9%, whereas the incidence rate of patients who had BPH/LUTS was 19.8%.

In general, the rate of acute urinary retention in men who have no risk factors or have never experienced acute urinary retention is approximately 2.2–8.5/1,000; the incidence rate is 18.3–35.9/1,000 in men who have BPH/LUTS or who have experienced acute urinary obstruction [22, 23]. It is still unclear to what

extent medical therapy reduces the rate of acute urinary obstruction in patients with BPH/LUTS. Depending on the type and duration of the medications taken, some studies have shown that medical treatment does not lower the incidence of acute urinary obstruction compared to a group taking placebo, while other studies have reported the relative risk reduction to be 79–85% in treatment group [24].

In this study, general anesthesia for endoscopic nasal surgery appears to be a very potent trigger of urinary retention in men aged over 60 years, and it has been shown that taking prescribed medications cannot lower the risk of POUR. However, there was a difference in the Qmax and Qavg of uroflowmetry parameters measured before surgery in patients with and without POUR in Group 3. Uroflowmetry are simple, non-invasive, diagnostic tests to measure the urine flow over time. There are many interpretation methods, and Qmax is one of the most commonly used indicators. Depending on age and gender, Qmax less than 15 ml/sec is accepted as decreased in men and it means there may be an obstruction or abnormal bladder contraction [25]. It is reported that acute urinary obstruction occurs 3.9 times more when the Qmax is 12 or less in men aged 40–70 years [26].

In this study, Qmax and Qavg on the uroflowmetry - performed within 1 year prior to surgery in patients receiving urology medical treatment - were found to be statistically significantly higher in patients without POUR. Although there are limitations in that these test results do not reflect the immediate condition before surgery, it is clear that restoration of urinary conditions through appropriate treatment is important for the prevention of POUR following general anesthesia in elderly male patients.

The average BMI of patients with POUR was slightly lower than that of patients without POUR, although there was no statistically significant difference between the two groups ($p = 0.071$). Obesity is known to have a strong association with BPH/LUTS and prostate inflammation, but its relationship with POUR is obscure [27]. Mean BMI was significantly lower in patients with POUR in a study of male patients over the age of 55 who had undergone colorectal surgery, and in a study of women undergoing laparoscopic cholecystectomy [28, 29]. In addition, a study has shown that the time to first spontaneous urination is delayed in patients with a lower BMI after spinal anesthesia [30]. Therefore, more research efforts are needed to better understand the development of POUR in patients who are underweight or of low normal weight.

Conclusions

In the present study, catheterization was needed for urinary retention in 15.7% of men aged over 60 years who underwent general anesthesia for endoscopic nasal surgery. Factors related to anesthesia and surgery did not contribute to the occurrence of POUR. The urological history was the only predisposing factor, and POUR occurred in 5.9% of patients without BPH/LUTS, compared to 19.6% of patients experiencing BPH/LUTS symptoms previously, and in 19.8% of patients currently taking medication for such symptoms. It is thought that general anesthesia is a potent trigger of POUR in elderly male patients, and the incidence of POUR would not be reduced by patients with symptoms taking BPH/LUTS medications, but would be affected by the urinary conditions reflected in the Qmax and Qavg.

Abbreviations

ASA = American Society of Anesthesiologists

BMI = body mass index (kg/m^2)

BPH = benign prostate hyperplasia

CI = confidence interval

LUTS = lower urinary tract symptoms

N = number of patients

OR = odds ratio

POUR = postoperative urinary retention

PVRV = postvoiding residual urine volume

Qavg = the average urine flow rate

Qmax = the maximal urine flow rate

TI = time interval between the uroflowmetry assessment and operation

TUR-B = bladder surgery with the transurethral approach

TUR-P = prostate surgery with the transurethral approach

VAS = visual analog scale

VV = voided urine volume

Declarations

Ethics approval and consent to participate

This study was approved by the institutional review board of Veterans Health Service Daejeon Hospital (reference number: VHSDJ-01-2020-0011) and complies with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This was a retrospective chart review therefore consent from patients was not obtained.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

YWL and JC designed the study, wrote the manuscript, and analyzed and interpreted the data. YWL, BSK and JC collected the data and provided critical comments. All authors read and approved the final manuscript.

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Figures

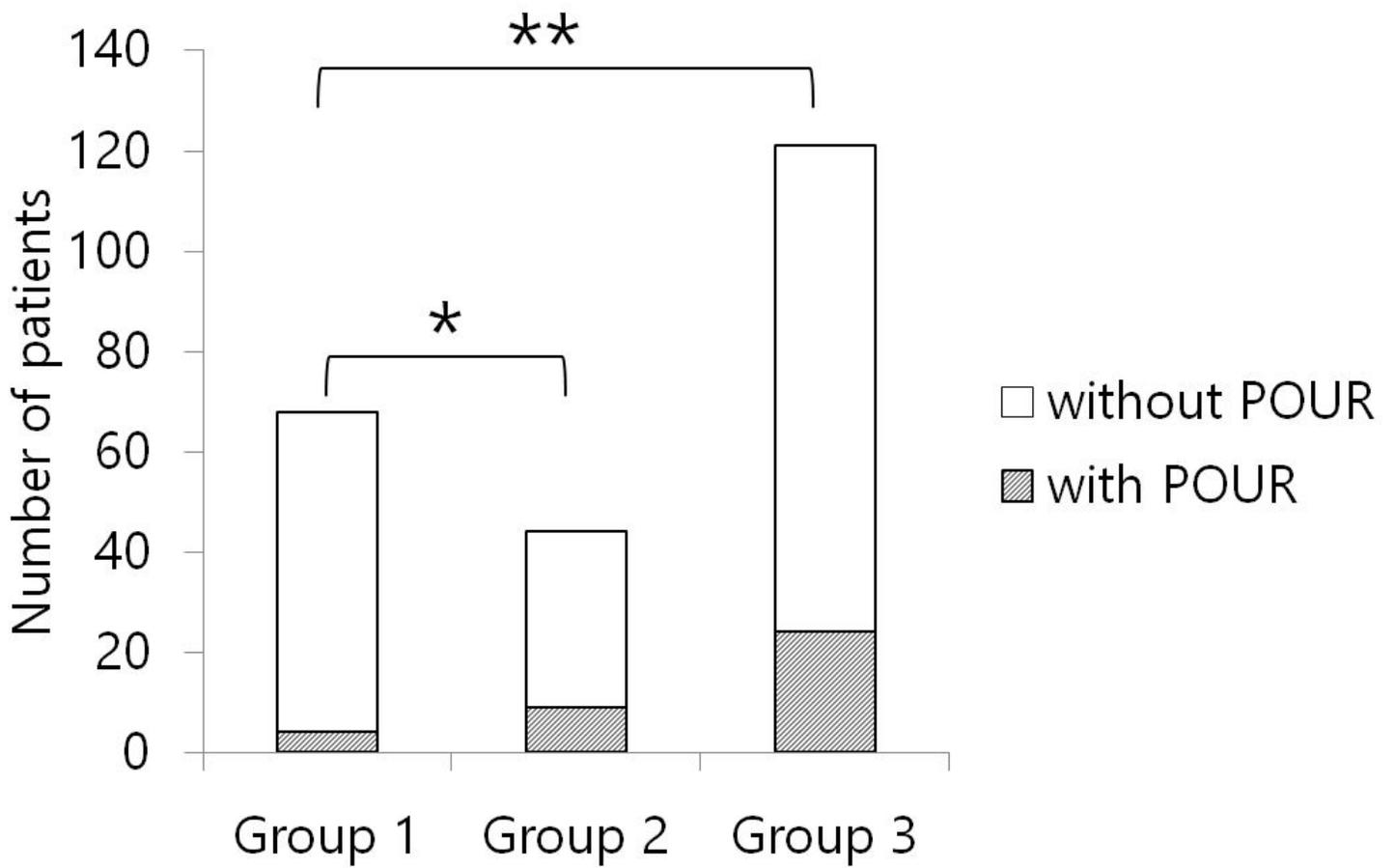


Figure 1

Comparison of the incidence rate of catheterization for urinary retention following general anesthesia for endoscopic nasal surgery. Patients are grouped according to their urologic history. Abbreviation: POUR = postoperative urinary retention. * $p < 0.05$, ** $p < 0.01$.